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THE AUTUMN CONGRESSES.

(*Continued from page* 132.)

THE NORMAL FORMS OF CLOUDS.

BY A. FOLLETT OSLER, F.R.S.

The object of this paper, which was read by Professor Balfour Stewart, was to explain a theory with regard to the principles that may have the greatest effect in producing the leading forms clouds assume. Premising that there were many additional influences that produce or propagate further changes and variations in these forms, but which might be regarded as exceptional or occasional, the author said that the causes with which his paper dealt might be classed under three heads :—1. The diminished specific gravity of the air when more or less charged with invisible vapour. 2. The differential horizontal motion of the atmosphere. 3. The vertical motion in the atmosphere produced by the heat of the sun's rays expanding the lower air. The first of these was universally recognised as the initial cause of the cumulus, the first-born primary cloud. The invisible vapour, however, that had raised the cumulus or crowning head of condensed vapour, would itself become visible should the atmosphere in which it was travelling become reduced in temperature by any of the cooling influences to which it might be exposed in its travels. The lower atmosphere being always charged with more or less vapour, the cumulus could only be formed when there was so much vapour generated as to float above condensation height. Thus far a calm was supposed to prevail. When the atmosphere was in motion its differential horizontal movement produced the first important modification. Owing to the friction of the earth from the irregularities of its surface and the denser state of the lower air, the upper portion of the cloud moved more rapidly than the lower, and the cumulus sheared over into a slanting position and finally assumed the form of the cumulus stratus. A young cloud was thus distinguishable from a long-travelled cloud ; indeed, one that had gone but a short distance was detectable. In this climate a large well-developed cumulus was seldom formed in the cold season, but they were frequent in summer. The majority of the clouds of the first stage seen in this country were born in warmer latitudes. They came as travelling cumuli, and showed more or less the condition of the cumulus stratus. The invisible vapour, however, was subjected to the same changes of form, due to differential motion previous to its becoming visible, but in this climate it soon rose to the same height at which it was condensed. In summer, and

especially in tropical climates, it might travel long distances in its invisible state, so that it had time to become elongated by differential action, and when condensed it at once assumed the form of the true stratus, in which case it was not seen as a cumulus or cumulus stratus at all. Examining the next stratum above they found that a rather rapid change took place to a drier atmosphere, as was proved by Mr. Glaisher's investigations with regard to the dew-point in his balloon ascents. The cirro-cumulus and cirro-stratus were now found. The differential movement of the atmosphere, though diminished, was still an important agent, and produced results that were not possible in the more bulky and dense clouds of the lowest range. Suppose the heat of the sun to have caused the lower atmosphere to expand considerably. The effect would be to lift up and spread the whole of the superincumbent air and lift the then upper stratum of cloud further from the earth. The flat cloud would spread in all directions, and would be rent into fragments or small groups, and thus produce what was called a mackerel sky, just as a similar result was produced, but by the reversed action, in mud that had dried up and shrunk into small patches while the damp earth beneath remained expanded by the moisture it still contained. Should, however, the expansion in the lower atmosphere take place very slowly, it was possible that the stratum of cloud might remain intact as simply an attenuated cloud. Supposing, however, the atmosphere to be in rapid motion, the cloud or group of clouds would be elongated in the direction of the current. This, if accompanied by expansion from below, would rupture the cloud into ribs or bars at right angles to the current. With a continuous current, and without expansion from below, longitudinal bars would be formed in the direction of the current. When, however, the cloud was stationary or moving slowly, larger or smaller filaments that might be prominent were drawn out in what were popularly called "mares' tails."

A NEW SUNSHINE RECORDER.

Mr. W. E. Wilson explained a new sunshine recorder. The instrument consists of two parts, one of which—the indicator—is affected by the sunshine, and the other registers the indications. The indicating apparatus was a differential metallic thermometer, made of a spiral of two metals (zinc and steel) soldered together. Half of the spiral is right-handed, and the other half is left-handed. The complete spiral is fixed at its upper end. At its lower end a lever or pointer is attached. The upper half, or right-handed portion, of the spiral projects through the roof of a ventilated box, and is exposed to the sunshine. The lower or left-handed half is in the shade. Any change in the temperature of the air does not cause the lever or pointer to move, as the upper half of the spiral tends to move it as much in one direction as the lower half tends to move it in the other. When the sun shines on the exposed upper half, the lever moves and completes an electric current, which passes through the recording part of the apparatus. The recorder consists of a drum, driven by a clock. The drum revolves once in twenty-four hours, and is mounted on an axis, with a screw of ten threads to an inch, which turns in a nut. This gives the drum a slight longitudinal motion, as well as its motion of rotation. The clock makes an electric contact once every minute, and the electric circuit is led through an electro-magnet, which causes a pricker to strike the drum when the circuit is complete. The circuit is led through the lever, &c., of the

bi-metallic indicator, and is only closed when the sunshine causes the lever to close it. When the circuit is complete the electro-magnet pricks a dot every minute, which represents a minute of sunshine. The drum is of such a length that it holds the daily record of sunshine for three months. The instrument is also made to give the total time during which the sun shone in the day.

At York, before the Congress of the Sanitary Institute, the following, among other, papers were read :—

PROFESSOR H. ROBINSON, M.Inst., C.E.—*River Pollution.*
CHARLES ROBERTS, F.R.C.S.—*Medical Climatology.*
SURGEON-MAJOR R. PRINGLE, M.D.—*The Collection and Storage of Rain and Drinking Water.*

Of these, the pressure on our space prevents us referring to more than one.

ON MEDICAL CLIMATOLOGY—A SCHEME FOR DEFINING LOCAL CLIMATES BY COMBINED METEOROLOGICAL AND PHENOLOGICAL OBSERVATIONS.

Having dwelt on the distinctions between meteorology and climatology, the author proceeded to state that if we examine the whole range of living things, we shall find that plants are most exposed to, and most distinctly declare, the geological and climatic conditions of a country or district. Being fixed to the soil, they show its character ; and being confined to one place they sum up the whole range of meteorological phenomena to which they are and have been exposed. The tolerance of different species of plants for different amounts of temperature, rainfall, sunshine, atmospheric impurities, &c., constitutes them veritable weather glasses, of different degrees of sensibility, from which we can gather a more distinct idea of the climate of the place in which they survive than from any number or combination of meteorological instruments : hence the advantages of the phenological method of studying climate.

Having shown how the idea, which is by no means new, had been utilized by Linnæus, by Quetelet, by the Committee of the British Association which revised Quetelet's scheme to suit our British flora and climate, by the Committee of the Meteorological Society, and by Dr. Hoffmann of Giessen, the author goes on to speak of observations received by himself from the Rev. T. A. Preston of Marlborough, and of his own elaborate working up of co-ordinate meteorological and phenological observations from these, and shows that it would not be a difficult task to construct short lists of plants, &c., to represent the various meteorological elements separately, and with a prospect of obtaining results which would be of great value to medical climatology.

1. The different elevations of a country are distinguished by different species of plants and trees, but as our country does not possess decided variations of this kind it is unnecessary to give such a list here.

2. A list of plants, even within a single natural order, such as Ranunculacea (the Marsh Marigold to the Traveller's Joy), could be constructed to show the relative dampness or dryness of the soil and atmosphere of two districts, but the rainfall and atmospheric humidity are best dealt with in conjunction with temperature.

3. The lowest range of temperature of a district is of great importance in connection with many diseases, and the selection of suitable winter health resorts, and the simple survival of many sub-tropical plants in temperate regions is a valuable indication of the general climatic conditions.

4. We possess no ready means of testing the relative purity of the air. The ozone tests fail us at the very outskirts of towns and manufacturing districts, and chemical analysis is difficult and not always satisfactory. Here the growth of plants is of great value, as different species possess different degrees of sensibility to atmospheric impurities of both a chemical and mechanical description.

5. Prevailing winds are indicated by the inclination of trees, especially of rapid growing ones like the common poplar, and by the greater freedom from moss and lichens on the weather aspect of exposed trees, especially of the pine family. Round the coast, and especially on the eastern side of England, trees lean inland from the injury done by sea breezes; but inland the south-west aspect of trees suffers most from winds. This is a subject which is deserving of more attention than it has yet received.

6. The presence or absence of sunshine is indicated by the relative prevalence of leaves and flowers. But this question is largely dependent on rainfall, as a large rainfall not only produces an excess of leaves, but, being accompanied by clouds, the sun becomes obscured by them. Sunshine is also related to temperature, and as a low temperature is shown by the postponement of the blossoming of flowers, and especially by the deficient ripening of fruits, the quantity and quality of the sunshine is indicated by ordinary phenological observations.

Schemes illustrating sections 3 and 4 were given, and a "schedule for determining local climates by phenological observation" constructed from the trees and plants included in Dr. Hoffmann's scheme, completed this valuable paper.

REMARKABLE SHOWERS.

To the Editor of the Meteorological Magazine.

SIR,—I am surprised that the letters of Mr. A. H. Jenkin in your issues of August and September have not elicited any correspondence from your readers. A shower of snails *per se* is not by any means impossible, and admits of ready explanation on the supposition that the snails were previously picked up by one of the small whirlwinds which are not uncommon in England. In the present case, however, the difficulty is the excessive number; one can hardly conceive their existence in any spot in sufficient quantity for a whirlwind to carry away the requisite number to deposit "from one to two thousand shells per square yard" over an area of three acres.

I have been looking up the subject of remarkable showers in the works of many of the leading writers on meteorology, and think a few extracts are of sufficient interest to justify reproduction. They are copied verbatim, that the importance which each writer attaches to the subject may be apparent.

Luke Howard, "Climate of London." 1833. Chalky Rain. The morning of the 24th April, 1781, exhibited here (in the

third region of *Mount Ætna*) a most singular phenomenon. Every place exposed to the air was found wet with a *coloured cretaceous grey water*, which after evaporating and filtering away left the ground covered to the depth of two or three lines.

This grey matter was an *oxide*, produced from a metallic base, or sublimate, ejected, along with a prodigious quantity of steam from the bowels of the mountain, and condensed along with that into this singular mixed rain.

PORTENTOUS RAINS OF MILK, BLOOD, &c.—*Pliny* cites some of these in his Natural History. *The Acta et Monumenta* record for the year, in which M. Acilius, and C. Porcius were consuls, a rain of milk and blood (probably of volcanic origin like the one above described, but the earth of two colours), adding as also often at other times. Again, under P. Volumnius and Servius Sulpicius, a rain of *flesh*, which did not putrify, for the fowls (the vultures) never came near it. In *Lucania*, in the year before Crassus was slain by the Parthians, and his numerous body of Lucanians with him, it rained *iron*. The appearance out of which this came was like sponges; and the haruspices predicted only *superna vulnera* (wounds on the upper parts of the body), the weapons coming from above. When L. Paulus and C. Marcellus were consuls it rained *wool*, about a year after which T. Annius Milo was assassinated; and while the indictment upon his murder was trying, it rained burnt bricks, as is related in the *Acta* of that year."

L. F. Kaemtz, "*Meteorology*," 1845.—SHOWERS OF SULPHUR. "Formerly, and even at the present time, flowers of sulphur have been said frequently to fall with rain; after heavy showers quiet waters were found covered with a yellowish dust, and, as it was easily inflamed, it was concluded to be sulphur; every year the newspapers contained notices of it. More accurate researches have proved that this dust is nothing else than the pollen of certain flowers, and of pines in particular, which was swept off by the wind, and precipitated with the rain; Elsholtz had said this as long ago as 1676.

SHOWERS OF BLOOD.—In the chronicles of the middle ages, showers of blood were often alluded to, for red spots were found on the ground and in the waters; and superstition traced in this the effects of divine anger. This phenomenon occurred from time to time. But microscopic researches have proved that these colourings arose from innumerable vegetables or animals that sometimes filled the waters. Frequently, however, a red powder fell with the rain, containing inorganic principles, and coloured with iron or hydrochlorate of cobalt.

Much attention has been directed of late to red snow; De Saussure, Raymond and others, had long ago seen it on the Alps and Pyrenees. In Baffin's Bay Ross found that the snow was sometimes penetrated several decimetres by the colouring sub-

stance; in the Alps it is observed on declivities that are slightly inclined. By the microscope they are seen to be red granules, the nature of which is not perfectly known.*

SHOWERS OF CORN.—After heavy rains bodies have frequently been found on the ground that possessed a distant analogy to grains of corn, and appeared, like the latter, to be composed mostly of farina, but it has long ago been demonstrated that these were not grains of cereals, and that they had not fallen from the sky. MM. Geoppert and Treviranus have lately studied this subject.

In June, 1830, there were found near Greisau, a village of Silesia, after a rainstorm, a certain number of bodies of a vegetable nature on places covered with turf. These corpuscles were exteriorly of a yellowish brown, of a transparent white within, spherical, occasionally cylindrical, being from 4 to 18$^{mm.}$ long, and from 2 to 4 in diameter. They had the taste of farina, but left in the mouth a sharp and burning after-taste. By rapid dessication, the sharp taste disappeared, and the grain had then the flavour of an almond. Accurate researches have shown that these grains were tubercles of the ficaire (*ranunculus ficaria L.*), a plant very common in Silesia.

SHOWERS OF ANIMALS.—Small animals, such as frogs, fish, snails, &c., sometimes appear to fall with rain; at least they are found in great numbers in fields after rain; but they are animals carried by the wind, drifted by the rains, or invited out of their retreats by the moisture. It has lately been maintained that these animals actually fall from the sky, even in calm weather. To all these assertions, I know no other answer than that which one of the most distinguished naturalists of the age made to some one who assured him that he had seen one of these phenomena with his own eyes. It is fortunate, he said, that you have seen it, for now I believe it; had I seen it myself I should not have believed it.

Sir J. F. W. Herschell, Bart., "*Meteorology.*" 1862. "Showers of fish, frogs, flannel (matted confervæ), bread (edible fungus), infusoria, and other unaccountable substances, are among the more palpable evidences on record of the elevating and transporting power of whirlwinds."

Andrew Steinmetz, "*Sunshine and Showers.*" 1867. "In the middle ages, when the 'anger of heaven' was almost the only means of bridling or frightening men, 'showers of blood' were frequently reported. The rain so designated has fallen in modern times, and the microscope has explained the mystery, tracing the red colour to innumerable microscopic vegetable 'cells.' . Red snow is found on the Alps and Pyrenees, and in Baffin's Bay, but the microscope proves the colour to result

* These granules may be considered as vegetables reduced to their most simple expression, namely to a cell filled with liquid. . . .

from red granules, the nature of which identifies it with a plant. Showers of corn have been reported, but scientific investigation has proved the supposed corn seeds to be the tubercles of the *Ranunculus Ficaria*. The 'showers of sulphur' consist of the pollen of certain flowers. . . . . Frogs, fish snails, etc., appear to fall with rain, but the only established fact is that they are found in numbers in fields after rain. If not wafted by the winds they are merely drifted by the rains, or attracted out of their retreat by the moisture. Of showers of soot, or black rain, we have recently heard much, and a volume has been written on the subject, but with Mr. Symons (our indefatigable authority on rainfall), we believe their origin is the chimneys, to which everybody seems inclined to refer them. The same expounder announces the fall of 'pumice-stone shoals' in Great Britain, but again, with Mr. Symons, without denying that rain may bring volcanic dust (instances of which are on record), we expect to hear of the phenomenon not from one parish or even one county only, but from observers in all parts of the kingdom; therefore, for the credit of the nineteenth century, any man asserting such facts should rigorously sift them ere he announces them to the public.

No doubt whirlwinds will carry up everything within their reach and transport them to a distance; but whatever falls in a shower must be of the earth—unless it be 'meteoric dust,' or matter resulting from the destruction of meteors, falling stars, &c.

Luke Howard witnessed 'a continuous shower of fragments of burnt paper, descending from an elevation which the eye could not appreciate'; but it originated from the burning of the Custom House (12th Feb., 1814), distant in a right line about five miles S., wafted by a S.E. breeze."

Alexander Buchan, M.A., Handy Book of Meteorology, 1868. "The *black showers* which occasionally fall in Scotland are in all likelihood the dust or scoriæ from the volcanoes of Iceland transported southwards."

During the present summer showers of this character appear to have been unusually numerous, for we have not only the shower of snails, which called forth this communication, but in the *Standard*, about a fortnight back, appeared an account of a shower of flies at Cupar, Fife, covering some 600 yards; and in a London weekly, dated September 18th, reference was made to reports of a shower of butterflies at Poole and two showers of frogs. I may perhaps be excused for concluding my letter with an appropriate riddle, which is the earliest meteorological recollection of my boyhood. "What's worse than raining cats and dogs? Hailing omnibuses."—Yours faithfully,

H. SOWERBY WALLIS.

25, *Northwood-road, Highgate, Sept. 28th*, 1886.

RECENT GALES.

To the Editor of the Meteorological Magazine.

SIR,—On October 15th, we were visited by a heavy gale, which wrought considerable damage to property.

It may be deserving mention, as a curious coincidence, that three of the most violent gales of recent times occurred on very nearly the same date of the year, namely :—

Sunday, October 14th, 1877.
Saturday, October 14th, 1881.
Friday, October 15th, 1886.

The first of these was the most destructive in its effects as regards this district.—Yours faithfully,

W. F. DENNING, F.R.A.S.

Bristol, Oct. 16th, 1886.

To the Editor of the Meteorological Magazine.

SIR,—We have just had a very great fall of rain with a violent N.E. gale. My gauge registered—from 3 p.m., Nov. 5th, to 9 a.m., Nov. 6th—1·88in., with an additional amount of 1·37in.; total, 3·25in. up to 9 a.m., Nov. 7—a very heavy fall for this part of Northumberland.—Yours truly,

JOHN COPPIN.

Bingfield, Corbridge-on-Tyne, Nov., 1886.

THE RECENT SUMMER AND THE WEATHER CYCLISTS.

To the Editor of the Meteorological Magazine.

SIR,—The *Meteorological Magazine* for June contained a letter from Mr. Brumham, in which he predicted that the late summer would be one of quite exceptional heat, inasmuch as there were no less than nine recurring hot periods, or cycles, which appeared to apply to the present year.

Perhaps the best comment on this prediction is the following extract from a letter which appeared in *Nature*, for August 12, from Mr. Charles Harding, on "The Persistent Low Temperature." After referring to the fact that the weekly weather reports issued by the Meteorological Office are compiled from observations at stations fairly representative of the whole of the British Islands, Mr. Harding proceeds to say, "These returns show that the low temperature is not limited to any special area of the United Kingdom, but is common to every part. From the middle of May to the beginning of August there was only one week, viz., that ending July 5th, in which the temperature was above the average in the western districts of England, Ireland, and the Channel Islands, whilst in the period of seven months from January 4th to August 2nd, the temperature in the north-west and south-west of England, and in the Channel Islands, has only been above the average in three weeks, ending March 29th,

May 10th, and July 5th; and, averaging the results for the whole of the British Islands, these are the only weeks in which the resultant temperature was above the average, and may fairly be considered the only warm periods during the seven months."

It is true that the temperature of the last two weeks of August was considerably above the average, but even so we get only three out of the thirteen weeks of summer in which the temperature was above the average. Nor was the heat in these three weeks of that exceptional kind which Mr. Brumham led us to anticipate, the maximum shade temperature at Greenwich during the summer having been only 87°, whereas in recent years it has frequently exceeded 90°, and on one occasion reached 97°.

I have given a good deal of attention to the predictions of the "Cyclists" for many years past, and have never met with an instance of a so-called weather-cycle which admitted of a crucial test being applied to it, that did not break down under the test, while all the seeming instances of successful prediction could be accounted for as mere coincidences, being balanced by at least an equal number of similar cases in which the prediction was not fulfilled.

GEORGE T. RYVES.

Tean Vicarage, Stoke-on-Trent, Sept. 30, 1886.

EXTRAORDINARY WHIRLWIND.

To the Editor of the Meteorological Magazine.

SIR,—I beg to enclose with my monthly report a cutting from a local paper, describing a storm last month. I made enquiries about the matter and found the statements correct, except that the boiler mentioned existed only in the reporter's imagination. I am, dear sir, yours faithfully,

W. H. KEMPSTER.

Ballinasloe, Nov. 2, 1886.

On Friday, October 23, one of the most extraordinary occurrences ever witnessed in this part of the country took place at Camla, Taughmaconnell, about four miles from Ballinasloe. At about 12 o'clock a man named Murray was making a hay-rick, when he, in his own words, heard "all of a sudden" a terrible noise in the air, and immediately large quantities of dust, boxes, branches of trees, hay, and oats passed by him and over his head. He was so much afraid that he lost all consciousness for a few seconds, and when he recovered he looked towards his brother's house, which was quite convenient, and saw that the end had been swept away and a large portion of the roof. Sticks and branches of trees were floating in the air, and the wildest consternation prevailed amongst the people of the village. Sergeant Lee, R.I.C., whose barrack is close by, proceeded to the place and found that the report circulated of a "fairy blast" was true, and that the hurricane had proceeded in a straight direction with such violence that it swept everything before it, whether hay, or oats, or stone walls, as if they had been leaves of trees. After wrecking Murray's house, the house of a man named Hurley was stripped, and a large rick of hay carried away to all points of the compass, as if it was composed of feathers. The

stone walls around the house were all blown down, and stones 4 cwt. were removed several yards, and one stone fully 5 cwt. was removed a great distance. Two large stacks of oats were blown by the wind in every direction, and two pieces of iron which depended from a rope at each side round the stack were carried high into the air, and were found about a quarter of a mile away. Malachy Graham's house, further on, met even worse treatment. The end wall was carried away, and two large stacks of oats and a rick of hay were taken away, and portions of them found two miles away. The dwelling and out-houses were shattered in a remarkable manner. All the walls around were levelled. In another house adjoining, which was also wrecked, there was a cart in the yard in which there was a large boiler. The cart, which must at least have weighed 5 cwt., was carried high into the air, and came down reversed, the body being entirely broken and the axletree smashed. The boiler was made little bits of. The damage done is considerable, and a great amount of property is destroyed. The storm went in a direct line, and appears to have expended itself on the Suck. The country around is moorland, and the large farmers are well to do. There is a large bog adjoining. What it was—whether hurricane or storm, or the worst description of "fairy blast," as the people affirm, cannot be told, but one thing is certain, the like was never seen before in Camla or Taughmaconnell.

BRILLIANT METEOR.

SIR,—Last Tuesday evening (2nd Nov.), at a few minutes after 8 p.m., I was startled by suddenly seeing a bright light, which turned out to be a meteor of extraordinary brilliance, in the northern sky, which it illuminated in a most beautiful manner with the vividness of a flash of lightning. As will be seen from the enclosed cutting from the *Western Morning News*, this unusually brilliant spectacle was generally observed in the west.

I am, Sir, yours truly,

ALFRED H. JENKIN.

Trewirgie, Redruth, 6th Nov., 1886.

We cannot re-produce the whole of the cutting, but extract the following :—

The Rev. C. H. Crooke, of Sheepstor, writes :—"The time was, as near as I can state it, 8.5 p.m., ; the body of the meteor appeared to be about eight or nine inches in diameter. It continued its course from N.E. to S.W. for about three or four seconds, and suddenly exploded noiselessly, leaving its course marked on the heavens as if by a red mark of fire scratched on them, which remained visible for some minutes. The colour and effect were similar to those of the electric light, and every object around became clearly visible."

A Torrington correspondent says :—"It passed towards the west, leaving a long tail which remained as a curved line of yellowish red for nearly three minutes."

The Rev. S. Rundle writes :—"A meteor of vivid luminosity passed over Godolphin at a quarter-past eight ; its course was from W. to N.E., and, during its passage of two or three seconds, it obscured the light of the moon which was shining brightly.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1886.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	69·6	24	32·2	11*c*	56·9	40·1	39·3	76	108·7	25·8	1·22	15	5·5
Malta	71·7	7	46·0	14	65·7	53·4	53·0	81	134·3	41·8	·83	8	5·0
Cape of Good Hope	89·0	16	45·0	29	77·6	54·9	56·6	85	...	...	·65	4	3·6
Mauritius	84·7	3	66·0	20	82·0	73·2	68·4	76	135·6	54·3	3·12	18	6·7
Calcutta	103·5	14*a*	64·1	6	96·2	75·2	72·6	68	157·9	53·3	·00	0	1·5
Bombay	91·2	5	71·1	4	88·2	76·2	72·2	72	148·7	60·1	·01	1	0·9
Ceylon, Colombo	91·0	5, 8	72·8	25	89·0	75·7	74·3	77	150·0	59·0	7·26	19	6·1
Melbourne	90·2	3	37·6	30	68·4	50·4	48·7	70	140·0	29·2	·95	7	6·2
Adelaide	94·4	2	44·6	14	72·8	53·6	47·0	56	149·9	36·0	1·42	8	4·7
Wellington	69·0	5, 6	42·3	16	62·9	51·9	50·1	76	132·0	39·0	4·96	10	4·2
Auckland	72·5	1	47·0	13	68·2	57·2	54·6	75	136·0	36·0	2·82	11	7·0
Jamaica, Kingston	92·1	26	65·7	16	87·5	70·3	68·7	76	...	...	4·14	...	4·4
Barbados	86·0	22*b*	67·0	3	82·0	73·0	69·0	70	147·0	...	·78	9	6·0
Toronto	74·5	23	20·2	4	53·7	36·1	38·2	74	...	14·5	2·96	12	5·9
New Brunswick, Fredericton	75·8	23	13·7	5	51·4	29·0	29·8	62	...	...	·30	5	3·3
Manitoba, Winnipeg	74·8	18	— 1·8	2	54·3	30·9	36·5	76	...	...	1·73	12	4·6
British Columbia, Victoria	62·0	6	32·0	4	55·1	40·9	...	...	...	...	1·67	10	...

a And 20. *b* And 23. *c* And 12.

REMARKS, APRIL, 1886.

MALTA.—Mean temp. 58°·8; mean hourly velocity of wind 9·5 miles; velocity averaged 30·5 miles per hour from 8 a.m. to 4 p.m. on the 10th. TS on 29th.

J. SCOLES.

Mauritius.—Rainfall 2·12 in., and pressure ·073 in. below average; mean temp. 0°·6 above average; mean hourly velocity of wind 13 miles; extremes 30·1 miles on 16th, and 2·5 miles on 19th; prevailing direction E. by S. T on 11th and 26th; T and L on 13th and 28th. A cyclone passed N., N.W., and W. of the island from 2nd to 9th, and another N.E., E., and S.E. from 14th to 19th; several vessels were dismasted in the latter.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·4, and mean amount of cloud 0·3 above their average; mean temp of dew point 0°·8, mean humidity 3, mean pressure ·018 in., and rainfall 1·28 in. below their respective averages. Prevailing wind S., S.E., and N.; dense fog on 6th; H on 22nd; hoar frost on 30th.

R. L. J. ELLERY, F.R.S.

Wellington.—Early part fine; wind changed on 11th from N.W. to S., with heavy R, 1·70 in. having been recorded on 12th, the max. for the month; then fine till 17th, and from 25th to 28th. Prevailing wind N.W., and frequently strong. T on 30th. A slight shock of earthquake on 19th. Rainfall 1·44 in., mean temp. 0·4, and pressure ·076 in. above their respective averages.

R. B. GORE.

Auckland.—On the whole a fine warm month, with heavy R (1·14 in.) on the 9th. Pressure unusually high throughout; mean temp. about one degree above the average. Rainfall nearly three quarters of an inch below the average.

T. F. CHEESEMAN.

JAMAICA.—The rainfall of the whole island was about twice the average. A smart shock of earthquake was felt at Kingston at 4.48 a.m. on the 18th.

MAXWELL HALL.

BARBADOS.—Pressure unsteady; mean temp. (76°·8) 2°·1 above the average; mean hourly velocity of wind 11·6 miles, 7 per cent. above the average; extremes 15 miles and 5 miles. Rainfall much below the average.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	3·73	XI.	Castle Malgwyn	9·40
,,	Margate, Birchington...	2·34	,,	Rhayader, Nantgwillt..	10·20
,,	Littlehampton	5·16	,,	Carno, Tybrith	7·13
,,	Hailsham	4·27	,,	Corwen, Rhug	5·16
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	6·62
,,	Alton, Ashdell.....	5·06	,,	I. of Man, Douglas	4·61
III.	Winslow, Addington ...	4·44	XII.	Stoneykirk, Ardwell Ho.	3·62
,,	Oxford, Magdalen Col...	3·16	,,	Melrose, Abbey Gate...	5·04
,,	Northampton	3·47	XIII.	N. Esk Res. [Penicuick]	4·50
,,	Cambridge, Beech Ho...	2·31	XIV.	Ballantrae, Glendrishaig	3·64
,,	Wisbech, Bank House..	4·57	,,	Glasgow, Queen's Park.	2·92
IV.	Southend	2·49	XV.	Islay, Gruinart School..	6·10
,,	Harlow, Sheering ...	3·09	XVI.	St. Andrews, Pilmour Cot	2·95
,,	Rendlesham Hall	2·24	,,	Balquhidder, Stronvar..	7·35
,,	Diss	2·52	,,	Dunkeld, Inver Braan..	4·08
,,	Swaffham	4·16	,,	Dalnaspidal H.R.S. ...	5·47
V.	Salisbury, Alderbury...	5·07	XVII.	Keith H.R.S.	2·29
,,	Warminster	4·27	,,	Forres H.R.S.	1·75
,,	Calne, Compton Bassett	5·75	XVIII.	Strome Ferry H.R.S....	5·78
,,	Ashburton, Holne Vic..	10·19	,,	Tain, Springfield.....	1·24
,,	Holsworthy, Clawton...	6·99	,,	Loch Shiel, Glenaladale	6·32
,,	Hatherleigh, Winsford.	5·28	,,	S. Uist. Ardkenneth ...	4·20
,,	Lynmouth, Glenthorne.	10·18	,,	Invergarry	4·50
,,	Probus, Lamellyn	7·18	XIX.	Lairg H.R.S.	...
,,	Wincanton, Stowell Rec.	5·07	,,	Forsinard H.R.S.	2·30
,,	Taunton, Lydeard Ho...	5·70	,,	Watten H.R.S.	1·66
,,	Wells, Westbury.....	4·63	XX.	Dunmanway, Coolkelure	10·64
VI.	Bristol, Clifton	4·94	,,	Fermoy, Gas Works ...	...
,,	Ross	5·18	,,	Tralee, Castlemorris ...	5·24
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	6·97
,,	Cheadle, The Heath Ho.	4·22	,,	Newcastle West	4·92
,,	Worcester, Diglis Lock	3·63	,,	Miltown Malbay.....	3·25
,,	Coventry, Coundon	4·23	XXI.	Gorey, Courtown House	6·59
VII.	Melton, Coston	3·98	,,	Navan, Balrath	5·40
,,	Ketton Hall [Stamford]	3·47	,,	Mullingar, Belvedere...	4·88
,,	Horncastle, Bucknall...	4·42	,,	Athlone, Twyford	5·43
,,	Mansfield, St. John's St.	5·35	XXII.	Galway, Queen's Coll...	3·69
VIII.	Macclesfield, The Park.	5·15	,,	Clifden, Kylemore	7·03
,,	Walton-on-the-Hill.....	4·41	,,	Crossmolina, Enniscoe..	5·66
,,	Lancaster, South Road.	5·96	,,	Collooney, Markree Obs.	5·44
,,	Broughton-in-Furness ..	6·34	,,	Carrick-on-Shannon ...	4·96
IX.	Wakefield, Stanley Vic.	3·28	XXIII.	Rockcorry.....	4·68
,,	Ripon, Mickley	5·27	,,	Warrenpoint	6·34
,,	Scarborough.....	2·47	,,	Newtownards	4·45
,,	East Layton [Darlington]	5·72	,,	Belfast, New Barnsley..	5·39
,,	Middleton, Mickleton..	5·66	,,	Cushendun	2·84
X.	Haltwhistle, Unthank..	4·61	,,	Bushmills	3·34
,,	Shap, Copy Hill	7·04	,,	Stewartstown	4·87
XI.	Llanfrechfa Grange	5·62	,,	Buncrana	4·68
,,	Llandovery	8·09			

OCTOBER, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·43	— ·27	·47	12	23	78·8	4	39·6	14	0	0
II.		Maidstone (Hunton Court)...	2·38	— ·08	·45	12	20	...	...	...	...	...	...
,,		Strathfield Turgiss	3·80	+ 1·06	·52	1	20	75·2	4	33·4	18	0	2
III.		Hitchin	3·65	+ 1·47	·48	12*a*	23	76·0	4	39·0	21	0	...
,,		Banbury	4·19	+ 1·43	·67	12	22	73·0	4, 5	34·0	22	0	...
IV.		Bury St. Edmunds (Culford)	2·76	+ ·59	·45	5	20	75·0	1, 4	35·0	22	0	...
,,		Norwich (Cossey)	2·45	+ ·12	·61	1	15	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	3·93	...	·48	6	24	68·0	5	39·0	18	0	...
,,		Barnstaple.....	7·27	+ 1·82	1·13	1	20	72·0	5	46·0	18	0	...
,,		Bodmin	8·49	+ 2·22	1·01	15	25	64·0	7	39·0	22	0	0
VI.		Stroud (Upfield)	4·44	+ 1·43	·52	12	20	74·0	5	41·0	13*d*	0	...
,,		ChurchStretton(Woolstaston)	4·79	+ ·19	1·30	1	21	71·0	5	41·0	11*e*	0	0
,,		Tenbury (Orleton)	3·47	+ ·23	·48	28	24	75·3	5	35·3	22	0	0
VII.		Leicester	4·23	...	·55	12	20	77·5	5	38·4	14	0	...
,,		Boston	2·98	+ ·95	·55	6	16	82·0	5	40·0	11*f*	0	...
,,		Hesley Hall [Tickhill].....	3·78	...	·61	6	19	71·0	4, 5	32·0	23	1	...
,,		Manchester (Ardwick).....	5·86	+ 1·43	·90	6	19	69·0	5, 12	40·0	11*c*	0	...
VIII.		Wetherby (Ribston Hall) ...	3·67	+ ·31	·75	4	14	...	...	...	...	0	...
IX.		Skipton (Arncliffe)	8·27	+ 1·01	·92	1	22	63·0	30	36·0	21	...	...
,,		Hull (Beverley Road)	3·29	+ ·69	·48	17	23	68 0	1, 4	36·0	23	0	2
X.		North Shields	3·21	+ ·70	1·01	1	21	62·0	3	37·5	23	0	0
,,		Borrowdale (Seathwaite).....	11·27	— 5·28	1·55	12	18	65·0	4	33·0	26	0	...
XI.	WALES.	Cardiff (Ely).....	6·76	+ 1·53	1·00	14	23	...	...	...	...	...	...
,,		Haverfordwest	8·42	+ 1·97	1·72	15	22	68·0	4	38·0	20*g*	0	...
,,		Plinlimmon (Cwmsymlog) ...	11·68	...	3·83	15	18	...	...	...	...	...	...
,,		Llandudno.....	5·77	+ 1·18	1·45	20	18	72·0	5	42·5	22	0	0
XII.	SCOTLAND.	Cargen [Dumfries]	4·77	— ·94	1·29	12	17	69·4	5	34·0	22	0	...
,,		Jedburgh (Sunnyside).....	4·65	+ 1·98	·80	12	22	65·0	5	36·0	22*h*	0	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	..	...	...
XV.		Lochgilphead (Kilmory).....	5·32	— 3·00	1·43	11	17	...	...	33·0	23	0	...
,,		Oban (Craigvarren)	4·19	...	1·13	11	16	68·8	5	32·2	26	0	...
,,		Mull (Quinish).....	3·95	...	·91	11	20	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·00	— ·31	·90	16	13	...	...	...	...	...	...
,,		Arbroath	3·28	+ ·41	·36	15	17	61·0	3	35·0	23	0	...
XVII.		Braemar	4·44	— ·04	1·40	15	23	64·2	1	25·7	23	2	10
,,		Aberdeen	2·48	...	·41	21	21	62·0	2	34·0	14	0	...
XVIII		Lochbroom	3·44	...	1·07	11	14	...	...	...	...	...	...
,,		Culloden	1·74	— ·55	...	...	...	66·0	5	30·0	26	2	12
XIX.		Dunrobin	1·90	...	42	3	11	60·5	7	33·0	26	0	...
,,		Kirkwall (Swanbister)..... ..	...	...	...	...	...	...	...	...	...	...	...
XX.	IRELAND.	Cork (Blackrock).....	5·96	+ 1·22	1·11	14	20	70·0	7	33·0	21	0	...
,,		Dromore Castle	7·77	...	1·78	14	19	66·0	4	34·0	26	0	...
,,		Waterford (Brook Lodge) ...	5·70	...	·93	11	19	65·0	7	31·0	22	1	6
,,		Killaloe	5·22	...	1·13	15	17	67·0	5*b*	33·0	27	0	...
XXI.		Carlow (Browne's Hill)	5·64	+ 1·53	1·01	15	22	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	6·16	+ 2·74	1·56	15	24	64·6	5	36·2	22	0	2
XXII.		Ballinasloe	4·64	+ ·21	1·18	15	17	62·0	4,5	31·0	22	1	0
XXIII		Waringstown	4·61	+ 1·00	·93	15	20	65·0	5	30·0	21	1	6
,,		Londonderry (Creggan Res.).	4·10	...	1·66	15	19	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·82	— ·50	1·07	15	18	66·0	5	32·0	21*i*	2	...

a And 15. *b* And 6, 7, 8. *c* And 14, 22. *d* And 20, 22. *e* And 23, 28. *f* And 14. *g* And 21. *h* And 23. *i* And 25.

+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON OCTOBER, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A mild, showery month, with rainfall considerably above the average. Field flowers were in bloom in great abundance, and trees were still very thickly covered with leaves. TSS on 19th and 20th, which were very severe in the neighbourhood of Aldershot, 14 miles E. of this station, with almost tropical R while it lasted.

HITCHEN.—The hottest October on record; max. temp. on 1st 74°, and on 31st 60°.

BANBURY.—Mean temp. 52°; T and L on 20th; L on 1st and 19th; high wind on 14th and 25th; very slight S on 9th; fog on 6 days.

CULFORD.—Rains with high winds were prevalent, and storms of H occurred very near though not at this station. T and L on 1st and 20th; fog on 18th and 19th.

LANGTON HERRING.—Rainfall ·32 in. above the average of 11 years. The temperature of the month was quite abnormal, and far in excess of that of any other October for 14 years. Mean temp. at 9 a.m., 4°·3 above the average. The max. temp. did not rise above 68°, but the min. only once fell below 42°. A few trees were uprooted during the gale of 15th and 16th. Thick fog on 31st, TS on 4th.

BODMIN.—Very heavy gales from W.S.W. and N.W. occurred on 15th and 16th, of the longest duration recorded here.

STROUD.—A wet but warm month. On the 15th and 16th, severe gales from S.W. and W. occurred, during which a large lombard poplar was blown down. T and L on 10th, 19th, and 22nd.

WOOLSTASTON.—The early part of the month was very warm, especially the 4th and 5th, when the temperature was exceptionally high. A terrific gale set in on the evening of the 15th, and raged all night, pressure having fallen steadily all day. Mean temp. 50°·4.

ORLETON.—The first half of the month was very warm, especially the first week, the temperature rising on the 4th to 74°, and on the 5th to 75°·3, the highest recorded in October since 1859, when on the 3rd it rose to 75°, and on the 4th to 77°. The mean of the month was about 2°·6 above the average of 25 years. After the first week the sky was generally cloudy. Very low pressure on the 16th was preceded by great wind on the 15th, and followed by heavy R (·44 in.) on the 17th. A great darkness passed over from N. to S. about 1.30 p.m. on the 19th, and L was seen after dark on the 20th. Fog was frequent.

HULL.—The middle of the month was very wet; the close was fine and dry, but cold. On the 3rd ·30 in. of R fell in 15 minutes, at 9 a.m.; T and L on 7th; pressure very low on 15th.

NORTH SHIELDS.—TSS on 1st and 21st; fog on 11 days.

WALES.

HAVERFORDWEST.—The month was remarkable for its heavy rainfall, for its stormy character from 9th to 17th, and for its mildness, there being a total absence of frost. The mean temp. (51°·6) is the highest recorded here for October. On the 15th (pressure at 3 p.m. 28, 20·8 in. cor.) occurred a storm of wind, the violence of which has seldom been exceeded in this locality. Many large trees were uprooted, and much damage was done to shipping around the coast. Tremendous floods occurred on the 15th, the highest seen for upwards of 40 years at the Canaston Bridge on the Eastern Cleddan river. Much corn was still in the fields at the close.

LLANDUDNO.—The leading features of the weather in October were a high temp., strong winds and a heavy rainfall. The mean temp. (53°·2) was 1°·8 above the average; the total range (29°·5) was nearly half a degree below the

average, while the mean daily range (8°·9) was nearly a degree and a half below the average. The temperature of the month as a whole was, therefore, not only high, but equable. There were several continuous wet days, in addition to the max. fall of 1·45 in. on the night of the 20th, notably the 1st, when ·93 in. fell, and the 12th, when ·62 in. fell. A thick sea fog set in late on the afternoon of the 8th, after a singularly bright and fine morning, and was so dense that the *Alexandra* steamer, due here from Beaumaris about 5 p.m., failed to reach the pier till midnight, when the fog cleared off. High winds were more than usually prevalent, particularly on the 16th, 17th and 18th, when there was a continuous heavy gale from the N.; the force of this storm was, however, not felt nearly so much here as along the S. and S.W. coasts of England and Ireland. Owing to the exceptionally heavy rainfall, the air was more humid than usual, and sunshine less abundant, only 68 hours being recorded during the month.

SCOTLAND.

CARGEN.—For the first nine days the temperature was unusually high, and the mean of the month was 2° above the average. The weather was damp and gloomy throughout, only 82 hours of sunshine being recorded, which is 40 hours less than the average. T on 4th; L on 6th, 18th, 19th, and 30th; gale on 12th.

JEDBURGH.—The month was marked by the great and continuous fall of R, which retarded the ingathering of the corn very much. In the higher districts of Roxburghshire, a great deal was still uncut at the close. The turnip and potato crops were generally excellent. The rainfall was the largest in October for 22 years, and 2·19 in. above the average of that period, the next wettest October being in 1872, when 4·36 in. fell. TS on 6th.

QUINISH.—The last half of the month was very fine and sunny, with occasional hoar frost.

OBAN.—A very fair month, and warm for the time of year, with a moderate rainfall. All crops were well saved. On the 15th, during the heavy cyclone, the sky was covered all day with small nimbi of fantastic shapes, moving rapidly from N.E. to S.W., with strong gusts from N.E., but no R; pressure fell considerable, and the air was oppressive and lurid grey in appearance. This station was on the skirts of the depression. T and L on 6th; H on 10th; aurora on 18th.

BRAEMAR.—An exceedingly dark, damp, dismal month, only 28 hours of sunshine having been recorded, with 19 days on which the sun was entirely obscured. Crops suffered much in consequence, and were still partly uncut at the close.

ABERDEEN.—While the rainfall was about half an inch below the average, the weather was damp and unseasonable throughout the greater part of the month.

LOCHBROOM.—The finest month of the season, the latter half being beautiful and enabling farmers to secure their crops in a perfect state. Brilliant displays of aurora occurred on the 27th and 28th, followed, as usual, by a sudden change, but not so violent as is frequently the case. Gale on 9th.

CULLODEN.—The first half of the month was generally favourable for harvest work, but from the 18th to the close the weather was calm, moist, and dull. Crops on the whole were well got in; potatoes good and free from blight, turnips fair. A heavy flood occurred on 18th.

IRELAND.

BLACKROCK.—The weather was very changeable, with great fluctuations of pressure. Mean temp. 51°·3. T on 10th.

DROMORE.—In the middle of the month a severe storm occurred, lasting for three days, 14th to 16th inclusive.

WATERFORD.—Rainfall 1·47 in. above the average. Fog on 6th, 7th, and 8th; T and L on 10th and 17th; S.W. gale on 14th; W. to N.W. gale on 15th; N.E gale on 16th.

KILLALOE.—Heavy floods occurred in the middle of the month, followed by very fine autumn weather and a light touch of frost.

DUBLIN.—A genial month as regards temperature, but R fell heavily and well-nigh incessantly during the first three weeks, 5·58 in. being recorded on 18 out of the first 19 days. On the 23rd pressure rose decidedly, and drying winds from E.N.E. of considerable strength set in and continued to blow for several days. Some bright sunshine was enjoyed at the close, the 31st being an exceptionally fine, clear day. The rainfall was more than double the average of 20 years. In 1880, in October, the rainfall was very large, 7·36 in. on, however, only 15 days, 2·74 being measured on the 27th alone in that year; and in 1875 7·05 in. fell on 26 days. On the other hand, in 1884 only ·83 in. fell on 14 days. In 1868 also—the "warm year"—the October rainfall was only ·86 in. on 15 days. Fog on 6th and 8th; H on 10th; high winds on as many as 13 days; gales on 4 days. Prevailing winds S.W., E., and N.E.; mean humidity 88; mean amount of cloud 6·0.

BALLINASLOE.—Heavy floods and high winds prevailed from 14th to 18th; many trees were blown down, and a temporary bridge over the River Suck was partially swept away. This was the heaviest flood since November, 1881. H on 10th.

WARINGSTOWN.—The rainfall of the early part of the month imperilled one of the finest harvests remembered. The third week, however, cleared the fields, and little damage was reported.

EDENFEL.—The temperature of the month was throughout much above the average, with but two nights of slight frost. As a result even the ash and the oak still retained their leaves at the close. On the night of the 14th a sudden and considerable fall of pressure took place, accompanied by high drifting wind and remarkably heavy continuous R up to the morning of the 16th, occasioning floods higher than any previously recorded here. From the 17th to the end of the month was generally fine and bright.

LAND AND SEA BREEZES.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Burder's letter in your last number, inasmuch as it reports the wind only twice in the day, does not assist in showing the direction in which the sea and land breezes change at Clifton; so that his examples fail to throw any light upon this question; they only show that, even as far from the sea as Clifton is, it is sufficiently near for the sea and land breezes to overcome the tendency of the wind to blow towards the sun, if such a tendency exists as I have suggested.

I do not understand his explanation of the veering of the wind. A cyclone lying to the north of an observer and moving eastward, undoubtedly causes the wind to veer, but only from a southerly to a northerly direction. This, therefore, cannot account for the veering that takes place as the wind changes from a westerly to an easterly direction, or the reverse. A cyclonic centre lying to the west of the observer in the evening, and to the east in the morning, at the times when the land and sea breezes change, would indeed produce the required effect; but I am not aware that cyclones are apt to be central in any particular place at any given hour of the day.—Yours truly,

T. W. BACKHOUSE.

Sunderland, Oct. 25th, 1886.